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Analysis of Economic Uncertainty Policies on Technology Innovation of 24 Countries (1997-2022)

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Abstract: The research examined the impact of uncertainty of economic policies on technology innovation in twenty-four countries (1997-2022). It examines the performance of economic uncertainty of technological innovation from the global economic policy uncertainty data (1997-2022). Stationarity checks where obtained from the time-series data, including the Augmented Dickey-Fuller unit root test for Lag differences. We assessed risks attached to economic policy uncertainty in 24 countries with in-depth analysis for it causes. Also, the study forecast the GEPU for current price in the next five years, using the Autoregressive integrated moving averages (ARIMA).

Keywords: Growth, Uncertainty, Forecast.

1. Introduction

Uncertainty could be a risk and disadvantage for government policies and investment concerns. Economic policies have a great influence on technological innovation, which can spread to different countries because of the global market and intercontinental trade among countries. Of one thing happens in one country, it has the tendency to spill over. Hassett and Sullivan (2016), in their survey, show that new empirical measures of uncertainty have emerged which allows economists to assess the impact of uncertainty in various aspects of the economy. Al-Thaqeb and Algharabali (2019) conduct a review of studies that use the economic policy uncertainty index (EPU) of Baker et al (2016) as a key factor in measuring uncertainty. As technology is growing, companies are faced with high risk of consumer needs change with time. These factors affecting their internal operations and more. Uncertainty about government policies, business decision makers are unable to assess risk and opportunity and make the trade-offs necessary for investment in new technologies. Khan et al (2019) investigate the effects of firm-specific, market-based, CAPM-based, and economic policy uncertainty on the relationship between leverage and investment for state-owned enterprises and non-state-owned enterprises. Different policies (R&D, health and safety, economic regulation) have different effects, depending on type of industry and size of firm. Because there are no established standards for judging industry performance, it is difficult to know whether policy uncertainty is simply a rationalization for not innovating or whether there is a cause and-effect relationship between policy uncertainty and technological change. At the macro level, innovations in policy uncertainty foreshadow declines in investment, output, and employment in countries.

Economic policy uncertainty is considered a risk as government policies and regulatory frameworks are undefined for the near future. This phenomenon may lead businesses and individuals to delay spending and investments because of uncertainty in the technological innovation market. As innovation could be different in certain context, industries are unsure as to whether they can meet future demands. Because of this, studies on uncertainty are significant, putting businesses and industries in better standing to tackle future shocks and risks.

The level of uncertainty is now higher and more important than ever before, since technology and globalization have transformed the way we live. Political division, polarization, and the increased role of government spending in the overall economy are major factors leading to the recent spike in uncertainty (Baker et al., 2013). Economic policy uncertainty is defined as uncertainty regarding economic policies such monetary policy, fiscal policy and regulatory policies, and it derives mainly from whether existing policies will change in the future (Baker et al. 2016; Danisman et al, 2021).

As economic policy is not certain, shocks and risk are evident. As a result, uncertainty about who will be making the policy decisions have economic consequences. In the midst of competiveness, companies thrive towards innovation, even when it is uncertain who will lead the market at the time. It is widely known that innovation is creating values by introducing something new, especially in the market. But economic policy uncertainty forbids growth in technology innovation through threats to foreign direct investment. For instance, innovation in business may be finding a new process to improve performance and increase output; innovation in medical and pharmacy may be inventing new vaccines that save million lives; innovation in technology can be designing new machines to boost productivity.

Several research has carried out in economic policy uncertainty for technology innovation, but few focused on the impact and changes of technology uncertainty and measuring the risk attached to it. As a result, this study assessed these risks and identifying their patterns for policy recommendations.

2. Literature Review

The association between innovation and economic growth first appeared in Solow's (1956) research, which discovered a long-term relationship between the two. Schumpeter (1912, 1939) contrasted between the concepts of economic development and growth. Thus, from his perspective, economic development was characterised by abrupt internal changes brought on by economic inventions that originated

from the economic system, as opposed to economic growth, which reflects a slow and gradual changing of the economic system as a result of foreign forces. Empirical studies (Aghion et al., 2005, 2009) have supported Schumpeter's economic growth model's emphasis on the importance of education and innovation-based competitiveness in promoting the advancement of the economy.

Pece et al. (2015), Hu and Png (2013) and Chadee and Roxas (2013) employed macro- and micro-level of information and considering business, domestic, and global aspects to determine the relationship between economic expansion and innovation. Pessoa (2007) also investigatedthe relationship between innovation and economic expansion and found no evidence of a direct link between expenditure on research and development (R&D) and growth in the economy. Therefore, in addition to R&D expenditure, innovation strategy must also use additional indicators to account for this complexity.

3. Materials and Method

The principal aim of the study is to examine the impact of global economic uncertainty for 24 countries. These countries are Australia, Brazil, Canada, Chile, Colombia, France, Germany, Greece, India, Ireland, Italy, Japan, Korea, Netherland, Russia, Spain, Singapore, UK, USA, SCPM China, Mainland China, Sweden, and Mexico. Data included GEPU at current price. The study used to give the estimates in the model.

Model description

Autoregressive integrated moving average (ARIMA)

Where:

4. Results

We present analysis of GEPU for the current price. The study used ARIMA (3, 1, 0).

Table 1. Model Description

Model ID	GEPU_current	Model_1	ARIMA (3,1,0)

Table 2. Model Fit

Fit Statistic	Mean	SE	Minimum	Maximum	Percentile						
					5	10	25	50	75	90	95
Stationary R-squared	0.167	.	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
R-squared	0.755	.	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755	0.755
RMSE	36.396	.	36.396	36.396	36.396	36.396	36.396	36.396	36.396	36.396	36.396
MAPE	20.964	.	20.964	20.964	20.964	20.964	20.964	20.964	20.964	20.964	20.964
MaxAPE	59.566	.	59.566	59.566	59.566	59.566	59.566	59.566	59.566	59.566	59.566
MAE	26.512	.	26.512	26.512	26.512	26.512	26.512	26.512	26.512	26.512	26.512
MaxAE	76.043	.	76.043	76.043	76.043	76.043	76.043	76.043	76.043	76.043	76.043
Normalized BIC	7.704	.	7.704	7.704	7.704	7.704	7.704	7.704	7.704	7.704	7.704

Table 3 provides the summary model statistics. It shows the model is stationary at 0.1t67, with the Bayesian information criteria at 7.704. The model is not significant at 0.05.

Table 3. Model Statistics

Model	Number of Predictors	Model Fit statistics		Ljung-Box Q (18)			Number of Outliers
		Stationary R-squared	Normalized BIC	Statistics	DF	Sig.	
GEPU_current-Model_1	0	0.167	7.704	9.034	15	0.876	0

Table 4 shows for every one unit of GEPU there is a reduction of 0.265 in one year time.

Table 4 gives the estimate for the model, using the ARIMA. It shows a three order and one differencing, with no white noise.

Table 4. ARIMA Model Parameter

					Estimate	SE	t	Sig.
GEPU_current-Model_1	GEPU_current	No Transformation	Constant		8.275	4.89	1.692	0.105
			AR	Lag 1	-0.265	0.237	-1.121	0.275
				Lag 2	-0.383	0.278	-1.375	0.184
				Lag 3	0.128	0.339	0.378	0.709
			Difference		1			

Table 5. Forecasted GEPU Values and Confidence Intervals

Variable	Dickey-Fuller
GEPU_current	0.921

The diagram shows there is no white noise because all points fall within the range for both autocorrelation and partial autocorrelation functions.

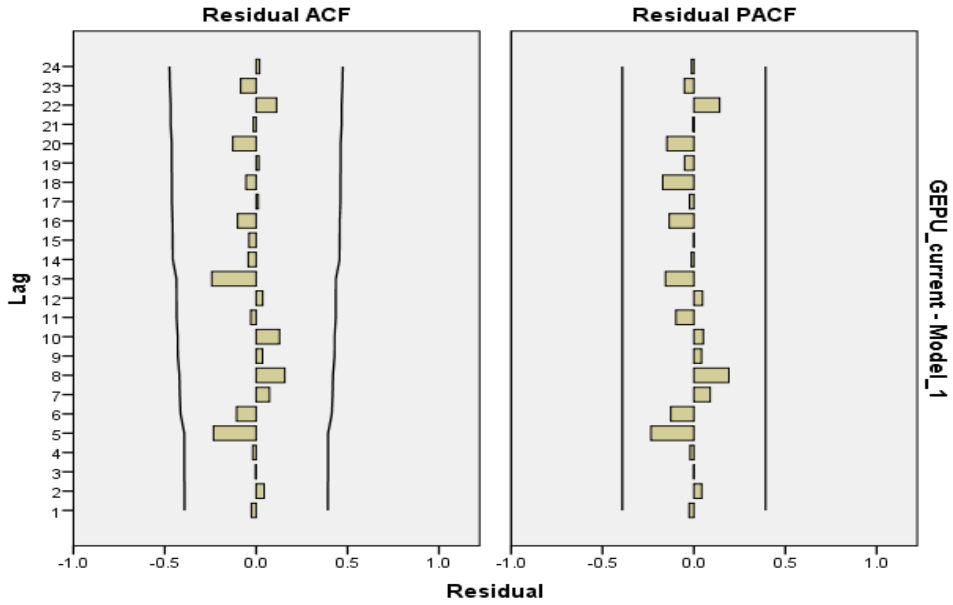

Figure 1. Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) Plots for ARIMA(3,1,0) Model Residuals

Figure 2 shows the forecast of GEPU, using the ARIMA method. The result shows for the next few years, technology innovation will fall within 250-350, which is far above its average. It implies the GEPU is expected to improve in 2026.

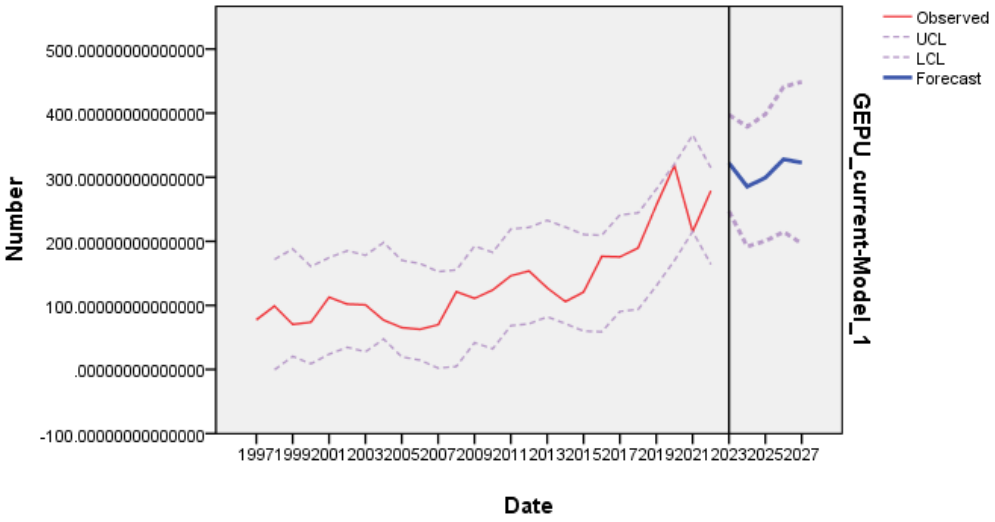

Figure 2. ARIMA Model Forecast of Global Economic Policy Uncertainty (GEPU)1997-2027

The technology innovation for the GEPU was way below the average from 1997 to 2010 with a little rise in the subsequent years, but later reduced in 2014 to 2015. It took up a new trajectory from 2018 to 2020, but a shocking downward trend in 2021. It kept showing a reasonably steady pattern for subsequent years.

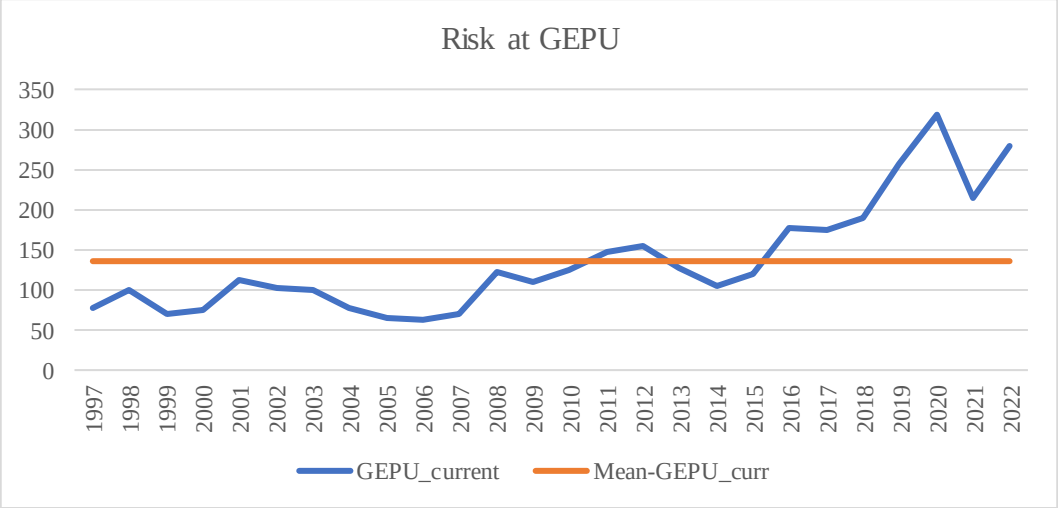

Figure 3. Historical Trend and Mean of Global Economic Policy Uncertainty (GEPU)1997-2021

5. Discussion and Conclusion

Technology innovation may help to boost the economy in High Income countries, but may not be the same for low Income countries. As the world is faced with rapidly growing demand for innovation, there is a need for proactively shape their countries' future The study used the autoregressive integrated moving average model to forecast the global economic policy uncertainty for 24 economies. As a result, the study revealed that the GEPU on technology innovation of these countries were fluctuating over the years, with high risk from 1997-2015. It complies with the significant effort of countries striving towards exploring new ways to improve on their businesses for long-time vision. The study used the Unit root test to check for stationary in the time series. Technology innovation has improved over the years, with countries showing their quest to do more.

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